L1 Calorimeter Trigger at $\mathcal{L}=2\times10^{33}$

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http://cmsdoc.cern.ch/~wsmith/Trigger2e33.pdf

Rates

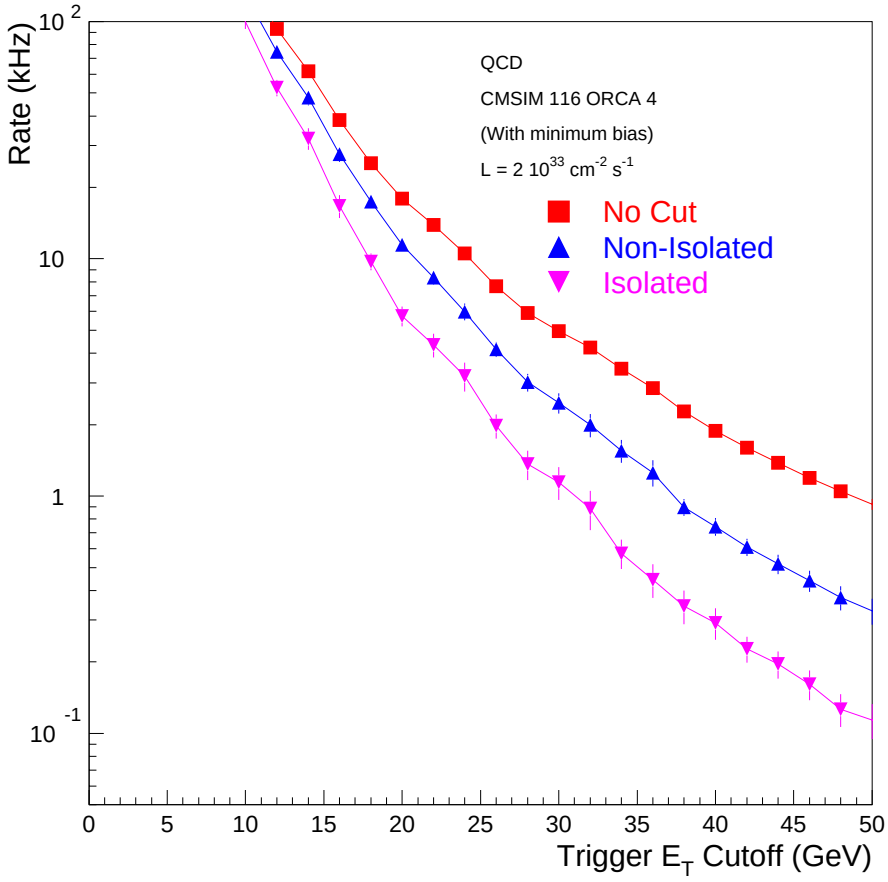
- **Rates estimated using old 10^{33} data (nTuples from Spring 2000 production**
- **Weighted by an additional factor of 2 over old 10^{33} data**

Results

- **threshold tables for several calorimeter trigger rate targets**
  - 12.5 kHz, 10 kHz, 8 kHz, 6 kHz, and 4 kHz
- **many physics channels explored**
- **different physics priorities explored**
  - balance rates of e/γ and jet triggers
- **Main Goal: keep physics efficiencies as high as possible**

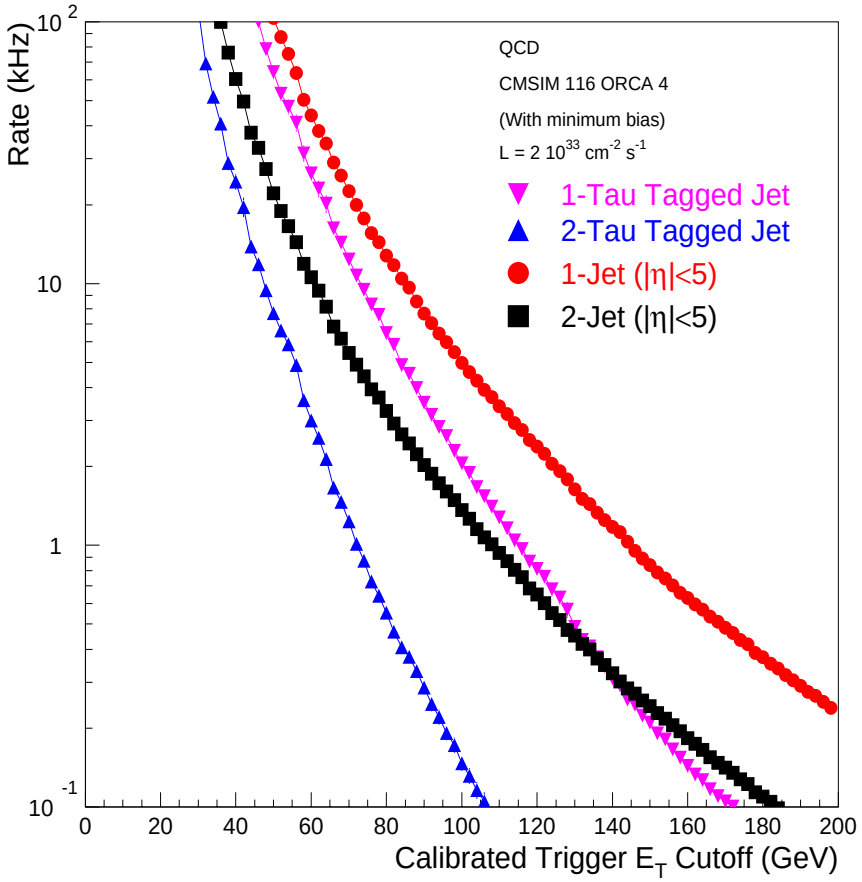
Rate plots for e/γ, τ-jets and jets

Low Luminosity e/γ trigger rates



Single e/γ at 27 GeV cutoff: 1.7 kHz

Low Luminosity Tau and Jet Trigger Rates



Single τ at 80 GeV: 6.5 kHz

Single jet at 120 GeV: 2.4 kHz

Same data as in Trigger TDR for $\mathcal{L}=10^{33}$

- **only the weighting has changed by a factor of two**

Why these rate choices?

Different DAQ staging gives different rate limits

- **100 kHz overall rate limit:**
  - 75kHz ÷ 3 safety factor × 1/2 for calo = 12.5 kHz as in TDR
- **50 kHz overall rate limit**
  - 50 kHz ÷ 3 safety factor × 1/2 for calo = 8 kHz
  - 50 kHz ÷ 3 safety factor × 2/3 for calo = 10 kHz
- **25 kHz overall rate limit**
  - 25 kHz ÷ 3 safety factor × 1/2 for calo = 4 kHz
  - 25 kHz ÷ 3 safety factor × 2/3 for calo = 6 kHz

Results

General Comments

- **Only isolated electrons (low $\mathcal{L}$ in TDR used non-iso as well)**
  - no B physics
- **All algorithms are as in the Trigger TDR**
- **No generator level cuts other than requiring e and τ to be in tracker**
  - $|\eta_{e,\tau}|<2.5$
  - Note: no off-line jet and missing E_T Cuts on invisible higgs underestimate the efficiency
- **No threshold increases for missing E_T and total E_T**

Physics channels

- **Six channels for $H \rightarrow \tau\tau$ and e/γ are all with TDR 10^{33} data**
- **All other channels are produced at UW on Condor or at FNAL**
  - Proper 3.4 events of pileup
  - Newer versions of CMSIM and ORCA

Target Rate 12.5 kHz

Two scenarios (p. 10 and p. 15 of note)

- **emphasize higgs channels (p. 10)**
  - good efficiencies for low mass higgs → close to 90%
  - $h \rightarrow b\bar{b}$ is low - not expected to exceed 90%
- **Balance e/γ and jet rates to capture channels like $W \rightarrow e\nu$ and $t \rightarrow eX$ (p. 15)**
  - $W \rightarrow e\nu$ improved over above higgs favored scenario above
  - $H(200) \rightarrow \tau\tau \rightarrow jj$ drops below 90%
  - Some slight improvements in electron channels

Channel	higgs emphasized	τ Contribution	e Contribution	e/γ and jet balanced	τ Contribution	e Contribution
$H(200) \rightarrow \tau\tau \rightarrow jj$	92%	85%	n/a	84%	68%	n/a
$H(200) \rightarrow \tau\tau \rightarrow ej$	89%	65%	64%	92%	47%	75%
$t \rightarrow eX$ (tag jets)	95%	65%	65%	95%	49%	74%
$W \rightarrow e\nu$	55%	n/a	55%	68%	n/a	68%

Target rate 10 kHz

Again two scenarios (p. 11 and p. 16 of note)

- **higgs emphasis (p. 11)**
  - Increased thresholds of mixed channels
  - Low mass higgs channels around 90%
- **e/γ and jets balanced scenario (p. 16)**
  - Better response of electron dependent channels
  - Slight threshold increases for mixed channels
  - Will higher e-jet make up for worse jet-jet?

Channel	higgs emphasized	1. τ Contribution	1. e Contribution	e/γ and jet balanced	2. τ Contribution	2. e Contribution
H(200)→ττ→jj	90%	85%	n/a	82%	68%	n/a
H(200)→ττ→ej	88%	65%	64%	91%	47%	73%
t→eX (tag jets)	90%	65%	65%	90%	49%	72%
W→eν	55%	n/a	55%	66%	n/a	66%

Other rates

8 kHz, 6 kHz (p. 12 and p. 13 of note)

- **Jet/τ thresholds increased**
- **Necessary increases in electron thresholds**
  - decreases seen overall

4 kHz (p. 14 of note)

- **very poor performance: jet and electron thresholds too high**
  - $H(200) \rightarrow \tau\tau \rightarrow jj$: 67%
  - $t \rightarrow$ jets: 70%
  - $W \rightarrow e\nu$: 47%!

Summary

10 kHz seems to be the very lowest rate we can take without hurting the discovery physics

- maintain high efficiency for lower mass higgs to e,jets
- PRS requested balanced e/γ and jet rates study

Studies need to be made with new 2×10^{33} data available at FNAL

- Hope that with new the τ algorithm the balanced scenario will improve for $H(200)\rightarrow\tau\tau\rightarrow jj$
- verify rates and pileup effects
- rates by September
- produce updated second note by October